Space Weather Forecast

Issued on Sunday, 17 December 2023 at 12:29 Local

This forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Minor/Moderate Geomagnetic Storm (G1/G2) likely on Day 1 (17 Dec) in a generally disturbed four-day forecast period. Risk of further Moderate Radio Blackouts (R2) and minor solar radiation storms (S1) now moderating slightly.

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Solar activity was Low, with the largest flare a long-period Common class flare peaking at 16/1434UTC. There are currently eight sunspot regions on the disc, with one region having departed on the west limb but a further new region appearing on the east limb. Most regions appear stable and magnetically unipolar. The main exceptions are the large and complex region which was responsible for the larger flares in recent days, which is now only partially visible near the southwestern limb. The two other regions of note are a further region close to the west limb, which has seen some alterations but is also difficult to view now, and a region near south centre disc, which is magnetically straightforward.
Whilst several Coronal Mass Ejections (CMEs) have been observed in the last 24 hours, none are considered likely to be Earth directed.

Solar Wind / Geomagnetic Activity: Solar winds initially showed waning combined CME and fast wind effects. A CME arrival then occurred in a data gap sometime between 17/0553-0733 UTC, which is thought to be the expected CME associated with the X-flare on the 14 Dec. Wind speeds declined gradually to around 440 km/s, but jumped after the CME arrived to around 540 km/s. The Interplanetary Magnetic Field was weak to moderate, briefly peaking at strong after the CME arrival. The north-south component varied weakly, often southward directed, then moderately after the CME arrival. Geomagnetic activity was Quiet to Active, with a G1/Minor Storm interval 17/0300-0600 UTC.

Energetic Particles / Solar Radiation: Proton flux was on a declining trend, having been raised in response to the recent larger flares from the complex sunspot. It was below the S1/Minor Radiation Storm threshold throughout the last 24 hours, however.

Four-Day Space Weather Forecast Summary
Solar Activity: There remains a chance of further Moderate activity and a slight chance of Strong, both largely tied to the fortunes of the largest sunspot group, which is due to rotate off the facing side during Day 1 (17 Dec). While some further active regions are likely over the eastern solar horizon, these are unlikely to fully compensate, and there is a step-wise moderating risk of significant flares as a result.

Solar Wind / Geomagnetic Activity: The CME from the Strong flare which occurred on 14 December reached Earth in a data gap sometime between 17/0553-0733 UTC. The magnetic field associated with the CME has now turned southward directed, and should this continue through the coming hours, some minor, perhaps moderate, geomagnetic storming is possible. There is one further weak possible CME in the forecast, which is low confidence, especially in timing, but may arrive either late on Day 3 or early on Day 4 (19-20 December). In addition, a coronal hole fast wind is due on day three, 19 December.
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Geomagnetic activity is likely to be Active to G2/Moderate Storm at first, with any G3/Strong Storm intervals now considered unlikely. This easing through Day 2, then a mixture of fast wind and CME influences are likely to bring a lower uptick on Day 3 to 4, with conditions most likely Unsettled to Active but with a chance of G1/Minor Storms.

Energetic Particles / Solar Radiation: High energy proton flux is now just very slightly above background, with a slight chance of exceeding S1 again should the large sunspot group flare appropriately. This probability then waning as the sunspot group rotates onto the far side.

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Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	70	20	30	20
Strong	G3	No	2	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	50	45	40	40
Very Active	R3 to R5 X	No	10	5	1	1

Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	20	15	10	10
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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